Beyond the Urban Fabric: Weaving Fiber into America's Rural Communities

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"Local governments everywhere want their communities to have affordable access to robust broadband infrastructure, just as local governments a century ago wanted their communities to have affordable access to reliable electric power. Then, with the private sector unable to electrify America everywhere at the same time, more than 3300 communities stepped forward to develop their own public power systems. Those that did generally survived and thrived, while many that waited for the private sector to get around to them did not."

~Christopher Mitchell, 2014

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Introduction

The term "digital divide" has become prevalent rhetoric in the US, referring to the separation between Americans who have access to reliable broadband internet services and those who do not (Talbot 2016). According to the Federal Communications Commission (FCC), in 2016, 34 million Americans had no access to broadband at all.[1] Many of these Americans live in small, rural communities and lack access to broadband infrastructure necessary for many basic tasks, such as job searching, homework, bill paying, health information, and social services. Similar to the pressing need for widespread electricity and road infrastructure in the early 20th century, fiber optic infrastructure that creates dependable access to broadband in homes and businesses in US communities is vital for contemporary economic development, especially in more remote or rural towns.

The lack of broadband access is often due to high fixed costs, which decrease the likelihood for private internet service providers to extend coverage to more dispersed and less populated rural communities. This undersupply of broadband availability in these communities has motivated a small number of municipal governments to invest in this infrastructure, thereby guaranteeing widespread access to homes and businesses.[2] In addition to increasing access, municipal broadband provision can increase competition, by providing access at

[1] The FCC defines broadband as a minimum of download speed of 25 megabits per second and a minimum upload speed of 3 megabits per second (FCC 2016).
[2] See Appendix I for a better explanation of fiber versus other types of broadband.

competitive prices below those set by natural monopolistic providers.[3] Municipalities can also contribute by encouraging broadband use in external ways; for example, by creating innovation districts and marketing fiber availability and its benefits to local businesses and residents. Ideally, with these municipal investments, small rural areas will experience positive labor force outcomes in their respective communities as a way to mitigate the digital divide.

Unfortunately, there is still a lack of research on the impacts of targeted municipal broadband investments. Because municipal fiber investments are expensive and take time to implement, it is important to understand how these investments translate to economic outcomes in the local labor force. Having a strong local labor force is crucial to economic development in small, rural towns to ensure these areas are not left behind in the digital divide. With a better understanding of how fiber investments translate to benefits for local workers, communities can make informed decisions about whether this type of infrastructure investment is worthwhile as a means to prevent the digital divide. In order to analyze whether municipal fiber investments are related to positive economic and labor force outcomes, this paper will focus on 73 municipalities in the US that have implemented municipal fiber optic networks. The analysis will focus on municipalities that invested in fiber networks between 2000-2011, in areas where networks are available to at least 80% of homes, businesses and institutions within their municipal boundaries.

[3] In order to create these long-term economic benefits, municipality and county governments do not necessarily have to operate the fiber optic networks they deploy; in many cases, it is also effective to allow private operators to bid on operations, or work with private partners, existing utility agencies, or co-ops.

Specifically, I will examine select economic indicators that pertain to the labor force, such as median income, unemployment, percentage of people who work in business/professional services and the percentage of people who work from home, to assess whether positive economic outcomes accrue to local workers in towns that have made these municipal investments, relative to the larger geography of their respective counties. Additionally, given that some municipalities with these networks perform better than others in terms of the select indicators, I will attempt to unpack the performance of a few of the best-performing rural towns. This will bring more insight into whether external factors, such as incentivizing policies and institutional supports, are important to leveraging municipal fiber optic investments to build a robust economy and local workforce.

Research Motivation

There is a clear need for additional knowledge about municipal fiber optic networks and associated economic development and labor force outcomes, stated as part of the federal agenda to increase broadband access to all homes and businesses in the US. In the fall of 2016, the National Telecommunications and Information Administration (NTIA) issued a request for comments to inform the development of a National Broadband Research Agenda, which "reflects the most significant opportunities for data collection, analysis, and research to keep pace with, and take advantage of, the massive digital changes that permeate our economy and society" (NTIA 2016). Responses to this request for comments were varied; they came from

large cities, states and rural coalitions, to various consulting, technology and infrastructure organizations.

Despite the variation in organizations, all respondents cited similar knowledge gaps in broadband research. The primary knowledge gaps identified were a lack of "outcomes-based evaluations…to understand the impact of broadband access, broadband utilization, and high-speed broadband for households and communities" (Berman 2016). Additionally, respondents claimed that there is a strong need to "conduct research and provide documentation on the economic benefits of targeted broadband adoption efforts" (Mattmiller 2016). My research hopes to address these knowledge gaps by using targeted municipal fiber investments as an example of bringing high-speed broadband to entire communities. By analyzing labor force outcomes in the municipalities that have made these investments, I hope to determine whether there are real economic gains for local workers on the municipal-level. Positive local labor force trends are crucial to maintaining a strong economy in communities across the US, mitigating the digital divide.

If the benefits of these targeted municipal networks to local workers become widespread and apparent, especially when wrapped with other services, it can help policymakers at the state and local level understand the long-term benefits of incentivizing municipal infrastructure investments and help communities find ways to deploy fiber. Municipal involvement in investing and promoting fiber infrastructure is in line with the national broadband agenda to increase access to high-speed internet, especially in rural areas where there is little or no access. Although there have been federal efforts to deploy fiber optic

networks, these are largely middle-mile efforts.[4] Therefore, municipal involvement is key to ensuring broadband availability in an area turns into access and operation for homes and businesses; local governments are crucial actors in providing last-mile fiber. With this research, I hope to provide more evidence of the positive labor force outcomes of municipally owned fiber networks that are up and running, in order to foster future investments. I also hope to provide specific examples of a few municipalities whose local labor forces have reaped the benefits of these investments and understand what these towns have done in addition to providing the physical infrastructure to contribute to economic development.

Literature Review

Existing Outcomes-Based Research on High-Speed Broadband

There is a need for more outcomes-based broadband research, as evident by the NTIA request and responses. Specifically, there remains little research on municipal fiber networks and economic outcomes in the local labor force, especially in rural areas. However, there have been several studies that broadly tie robust broadband and fiber optic networks to positive economic outcomes in general. In order to explore the idea that that gigabit fiber broadband is a catalyst for economic growth, one study looks at gross domestic product (GDP) per capita in different metropolitan statistical areas (MSAs) across the US. By comparing MSAs where over

[4] While the U.S. has an extensive network of middle-mile connections (long, intra- or interstate physical fiber or cable network connections) with the capacity to offer high-speed Internet to a large majority of Americans, many consumers lack access to the critical "last-mile" infrastructure. This is the infrastructure of the physical network that bridges homes and businesses to the broader middle-mile system (Executive Office of the President 2015).

50% of residents have access to gigabit internet speeds to MSAs where people have little access to gigabit networks, The Analysis Group examines whether MSAs with more access are correlated with positive economic outcomes, as measured by GDP per capita. This research reveals that in MSAs where the majority of households have access to gigabit broadband, GDP per capita is, on average, 1.1% higher than MSAs where households have little or no access to gigabit internet (Sosa 2014). Although this analysis cannot establish causation, it provides promising evidence of the linkage between positive economic gains, as measured by GDP, and privately-provided fiber networks in US cities.

However, there are several issues with this research. First, MSAs are large geographies and the distribution of gigabit fiber service offerings is likely far from uniform across entire MSAs, which are composed of many different municipalities. My research seeks to control for this issue by targeting municipal geographies with municipal fiber networks, meaning broadband is available to almost all homes and businesses within the town's boundaries. By looking at MSAs, the Analysis Group does not control for geographic distribution of fiber access across an MSA and there could be a lot of variation i.e. certain areas (such as high-income areas) have much more access than others. Additionally, the economic outcome of GDP per capita could be explained by many other factors, such as a few high-productivity firms or industry clusters in one part of the MSA that are driving overall growth. Additionally, this study only looks at urban areas, ignoring possible linkages between robust broadband access and economic outcomes in rural areas, which my research hopes to address.

Outside of measuring GDP as a potential economic outcome correlated with access to high-speed broadband, there are some studies that examine outcomes such as home values, employment, and payroll in geographies that have access to fiber optic infrastructure. Although none of this research looks specifically at municipal-wide fiber networks, it establishes grounds for my hypothesis that municipal fiber is related to positive economic outcomes, specifically in the local labor force. For example, a recent Fiber to the Home (FTTH) Council white paper analyzes housing data from 500,000 home sales across the US from 2011-2013. The white paper presents a strong positive correlation between home values and access to gigabit fiber internet services, revealing that on average, home values are $5,400 higher[5] if a home is located in an area with access to gigabit fiber. However, like the research on GDP gains, this research also does not control for the fact that homes with fiber access may also be predisposed to higher-income areas. Therefore, the positive association between access to fiber and home values as an economic outcome highlights the importance of my research on municipal-wide fiber implementation initiatives, which bring fiber access to an entire community. It is important to study economic outcomes of municipal-wide networks because these investments have potential to equitably increase the economic well-being of all residents across an entire community.

Additionally, there is some research that specifically analyzes labor force outcomes related to high-speed broadband access, but it is not at the municipal-level. For example, one study attempts to measure the economic effects of broadband in California by gathering survey

[5] This is 3.1% of the median value of a home in the US (Gross 2015).

data on high-speed broadband usage from 2001-2006. This analysis uses a panel regression to show that increased access to high-speed broadband in California has a positive and significant effect on employment growth and payroll across the state (K.A. Van Gaasbeck 2008). Again, however, this research lacks the analysis of outcomes for targeted geographies, such as municipalities, where a very high percentage of the population has access to high-speed broadband. The targeting of municipalities that have widespread access is a way to take a deeper dive into the impacts of access to high-speed internet on labor force outcomes.

Outcomes-Based Research Using Targeted Geographies

Generally, the existing research that has looked at economic outcomes in relation to access to high-speed broadband—in terms of metrics such as GDP, home values, and labor force outcomes—uses large geographies that do not address geographic variation in broadband access within the larger geography of interest. In order to best understand how high-speed broadband access is related to economic outcomes, it is necessary to hone in on specific areas where there is uniform access to high-speed broadband. Although this research is sparse, there are a few studies that attempt to address this problem by analyzing outcomes at the county-level geography, which my municipal fiber network research hopes to build upon.

Perhaps the most robust study that tackles this geographic issue focuses on broadband adoption in rural counties across the US as they are related to labor force outcomes. Researchers at Cornell classify county broadband adoption rates in non-metropolitan counties into quintiles to look at demographic and labor force outcomes. They find that there is a significant difference in median household income, unemployment, education, and number of

firms for counties with high (above 60%) versus low levels (below 40%) of broadband adoption, with counties with high adoption rates experiencing positive economic and labor force outcomes (Appendix II). This implies that in non-metropolitan, or rural, counties, there are economic gains from "mobilizing populations to subscribe to and use broadband capabilities" (Whitacre 2015).

Economic gains at the county-level are also evident in a study based on Lake County, Florida, where an extensive municipal fiber optic network in Leesburg was built in 2001. The study uses retail sales at the county-level as a proxy for economic development, and analyzes growth in retail sales compared to neighboring counties before and after the fiber network in Leesburg, Lake County was built. The researchers conclude that there were sizable and positive economic effects in Lake County, with retail sales increasing over 100% compared to neighboring counties in the year following implementation of the fiber network (Ford and Koutsky 2005). Additionally, the researchers point out that "it is important to understand that Lake County's peers no doubt had at least some private broadband network in their communities during the period evaluated, but these privately-owned networks did not produce the sizeable growth we observe in Lake County" (Ford and Koutsky 2005). Clearly, there are cases where public investments in fiber networks contribute to positive economic outcomes.

The existing research on positive economic outcomes establishes grounds for my research that specifically targets labor force and economic development outcomes in places with municipal-wide fiber broadband. I hope to take the research on high-speed broadband in targeted county geographies a step further by looking at labor force outcomes, as several

existing studies have done, but on an even more granular level. By examining labor force outcomes with municipal-level data for towns that have implemented municipal-wide fiber networks, I will capture the fact almost all residents and businesses in the area have access to gigabit fiber, to see if these investments have positive impacts on the local labor force in the entire community. In addition, comparing labor force outcomes in these municipalities with the larger surrounding county geographies, where access is presumably lower, can help determine whether these investments have positive long-term economic benefits for local workers, especially in rural areas. This will become even clearer by focusing on a few specific municipalities who have particularly experienced economic development benefits related to fiber optic investments.

Methodology

This research on municipal fiber optic networks employs both quantitative and qualitative methods. First, I focused on gathering quantitative data to get a preliminary grasp on the municipalities in the US that are actively involved in deploying fiber optic networks, and the labor force trends in these select towns. Then, by using the data analysis as a broad springboard for case studies, I took a deeper dive into labor force trends and economic development in three select rural municipalities from the original dataset. Positive gains for the local labor force, especially in rural communities, are crucial to maintaining a local strong economy in this era of the digital divide. This deeper research was done via qualitative methods, namely, using in-depth interviews with municipal economic development officials and

telecommunications experts in each of the respective towns. The goal of this qualitative research was to unpack the motivation behind fiber investments, and also provide insight into labor force and economic development trends since the deployment of these networks. For each municipality of interest, I conducted a couple of interviews in order to get a comprehensive picture of the economic development initiatives in the town and form better understand the relationship between the widespread availability of fiber and economic development in the labor force.

Quantitative Methods

In terms of the quantitative analysis, the goal was to understand economic growth trends in the labor force for towns that have invested in municipal fiber since the early 2000s. Therefore, I obtained a list of over 150 towns across the US that have made municipal broadband investments of some sort between 2000 and 2011. The list was provided to me by Christopher Mitchell, in a report that was initially released from the White House in 2015.[6] Towns in this list were categorized as having either cable, wireless, or fiber networks, and also classified as having citywide (at least 80%) or partial access for residents and businesses in each town. I limited my dataset to towns with fiber networks that had citywide services available to residents and businesses, in order to scrutinize if municipal-wide access is related to positive outcomes.

[6] Unfortunately, due to the change in executive administration in 2017, this exact report may no longer be available.

After vetting the list, I was left with 73 towns (Appendix III). I used the US Census and American Community Survey (ACS) to gather data on economic labor force indicators that, according to the literature review, might be changing over time in correlation with investments in municipal networks. These included unemployment, number of people who work from home, median household income, median home value, and workers in business/professional services. Similar to methods employed by Ford and Koutsky (2005) for their analysis of economic outcomes and fiber networks in Florida, I gathered data in a pre-fiber implementation year, and also post-fiber implementation, in order to try and capture a possible correlation between labor force outcomes and the implementation of a municipal network.

Therefore, data was obtained for the years 2000 (pre-fiber) and 2011-2015 (post-fiber), from the 2000 Census and the 5-year estimates for 2011-2015 from the ACS. For the purposes of this analysis, 5-year rolling estimates were used in order to improve accuracy, because several of the municipalities are very small and data is limited. I also gathered the same indicators for the counties where these municipalities are located, which was 48 counties in total. I parsed the data into two categories: the counties and towns that are part of a metropolitan statistical area (MSA), and those that are not included in an MSA and therefore, predominantly rural. This was done as an attempt to separate out the effects of economic growth in urban areas in contrast to rural areas, because rapid urban growth has been a trend in recent decades and could result in omitted variable bias.

In order to account for different sizes of towns, I normalized the unemployment, home worker, and business/professional services workers by labor force population in each

municipality and county for 2000 and 2011-2015. I then calculated the percentage change (essentially the second derivative) to assess how these select indicators changed over time. The first thing I examined were the summary statistics for each variable to assess whether in general, these towns and counties were experiencing positive economic growth since 2000. I then performed difference of means t-tests to assess the differences between changes in the labor force for the select municipalities and counties. From the significant results, I selected three towns with positive labor force outcomes for in-depth analysis.

Quantitative Limitations

Using changes over time for this analysis was essential in order to normalize the data, but there are certain caveats to this approach that should be mentioned. Given macroeconomic trends in the US economy, it could be argued that using the year 2000 as a pre-fiber benchmark is concerning, given the dot com crash in March 2000. This macroeconomic downturn could result in unusually high unemployment rates, for example, impacting municipalities and resulting in a larger change in unemployment for the municipalities than the counties over the period of study. In order to rule this out, I examined the mean unemployment rates in the sample of municipalities and counties over time. Although the municipalities did have a higher average unemployment rate in 2000, the sample of municipalities also had a higher standard deviation in unemployment than the counties (Appendix IV). This makes sense, given that the municipalities represent smaller geographies and would tend to have more fluctuations. After performing a difference of means t-test, it was established that there is no significant different

between county and municipal unemployment rates in 2000, despite the mean values of the samples.

Even so, given the potential caveats of using 2000 as a pre-fiber base year for analysis, it would be ideal to use a later date the represents a very stable economic year. Unfortunately, however, the ACS was not released until 2005. In this sample of 73 municipalities, 32 of them implemented their fiber optic networks between 2000 and 2005, meaning that the year 2000 was a necessary benchmark to capture these towns. Given data limitations of the US Census, the year 2000 was necessary to use for the purposes of this analysis. Overall, the data analysis is simply a means of sorting out promising towns for case study analysis, which is a way to gain fuller insights into the labor force and economic development trends in a few of these small, rural towns with municipal networks.

Qualitative Methods

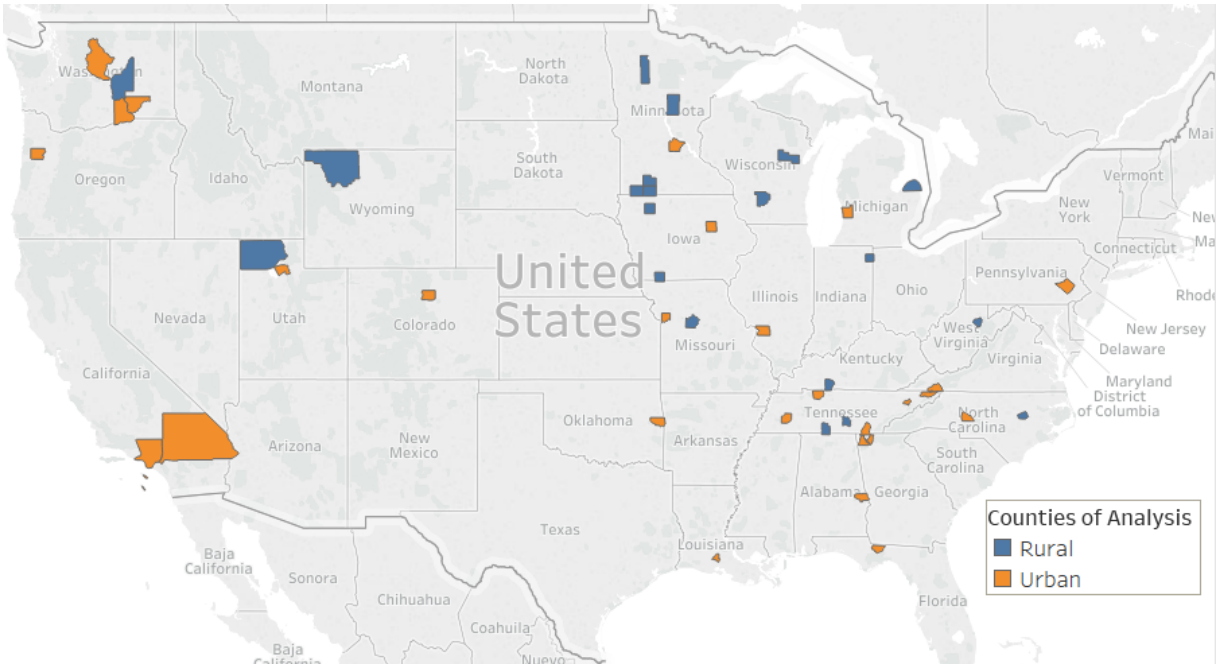
In terms of the in-depth qualitative analysis informed by the quantitative analysis, I reached out to municipal officials in the chambers of commerce, mayor's office/city council, municipal telecommunications organizations and, if available, economic development organizations in the municipalities of interest. After speaking with one individual, I was able to use the snowball method and connect with another individual in town who was also knowledgeable about the municipality's involvement in deploying the fiber optic network, and other ongoing economic development efforts in town. The goal was to comprehend the motivations behind fiber optic deployment on the municipal level i.e. how the initiative came about, as well as its impacts on the labor force and economic development strategies that are

ongoing today. The objective was to get at whether these investments, from the municipality's perspective, have made a difference for the labor force and what takeaways can be drawn from their stories to inform other municipalities of the relevance of fiber optic initiatives, and potential outcomes of these investments.

Data Analysis & Results

The purpose of this data analysis is to look at labor force outcomes in US municipalities that have publicly-owned and operating fiber optic networks that are available to at least 80% of businesses and residents within the municipal boundaries. These labor force outcomes are compared to the counties where these select municipalities are located, to see if there is a noticeable difference in labor force trends. In total, labor force data is drawn from 73 municipalities in 47 counties across the US. Of these, 34 of the municipalities and 20 counties were defined as rural, or located outside of a larger MSA (Figure 1).

Figure 1: Counties with Municipalities that have Municipally-Owned Fiber Networks



Although this analysis does not establish any causation between labor force trends and the presence of municipal fiber optic networks, it can allow some insight into whether these municipalities that have citywide fiber networks are on average, experiencing positive labor force trends relative to a larger geography. The focus of this analysis examines growth rates for the following four labor force indicators between 2000 and 2015:

- Unemployment rates
- Median income growth
- Percentage of the labor force that work in professional and business industries
- Percentage of remote workers or people that work from home

These indicators were normalized by the labor force population in each corresponding geography, in order to account for different size municipalities and counties that would

misrepresent the results. Additionally, median incomes were normalized to 2015 dollars to account for inflation.

First, in order to make sure that these labor force indicators did not directly relate to one another, it was important to see if any of the indicators were correlated. A correlation matrix reveals that none of these variables are highly correlated, with all the variables having correlations of 0.2 or below, so the statistical tests for each indicator that compare the municipalities and counties are not repetitive (Table 1).

Table 1: Correlation Matrix of Labor Force Indicators

	Change in Unemployment	Change in home workers	Change in business and professional services workers	Change in Median Income
Change in Unemployment	1	-	-	-
Change in home workers	0.0634	1	-	-
Change in business and professional services workers	0.0353	0.1516	1	-
Change in Median Income	-0.0941	0.1798	0.1966	1

For each indicator, difference of means t-tests are used to assess whether there is a significant difference of means in the sample between municipalities that have fiber networks versus the broader county geographies, where fiber is not widespread (Table 2).

Table 2: Difference of Means Test for Labor Force Indicators

Indicator	Mean of counties	Mean of municipalities	Counties > municipalities p-value	Counties ≠ municipalities p-value	Municipalities > Counties p-value
Change in unemployment	.4246	.2454	.9448	.1104	.0552*
Change in home workers	.1192	.5157	.0401**	.0802*	.9599
Change in business and professional services workers	.0249	.0957	.1052	.2150	.8948
Change in median income	1.7489	1.8211	.3522	.7043	.6478

*Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Although this analysis is very high-level and cannot pinpoint any causation, i.e. that fiber optic networks are responsible for positive labor force outcomes, it does reveal some interesting insights from pre- to post-fiber implementation. Clearly, the change in business and professional service workers is not significantly different. In both the sample of towns and counties, on average, there was little change in business and professional workers from 2000-2015. Additionally, although on average median incomes rose for both groups, there is also no significant difference in the rates of increase from 2000-2015. However, there were significant differences between the municipal and county groups for changes in unemployment and the proportion of home workers over time. This analysis shows that the change in unemployment is significantly lower in these select municipalities with fiber networks than the overall counties. Although both the municipalities and the counties experienced increases in the unemployment rate over this time period, the municipalities have a significantly lower rate of unemployment growth on average, significant at the 90% confidence level. It should also be noted that the growth in people who worked from home was significantly greater for the group of municipalities than counties. On average, from 2000-2015, the percentage of people who

worked from home in these municipalities increased 52%. This difference of means, with the municipalities having a higher average growth in people who work from home, is significant at the 95% confidence level. Although this analysis does not facilitate causation, it would seem that municipal fiber optic networks could be related to the increase in people working from home, due to the robust and reliable internet.

However, due to larger trends in urban growth, there could be other factors that explain why these municipalities have significantly lower rates of unemployment growth than the surrounding counties and higher rates of growth of people working from home. The literature reveals that municipal fiber optic investments are often most needed to create employment opportunities in rural municipalities and counties, where there are very few internet service providers and unemployment rates are generally high. Therefore, I decided to isolate rural counties and municipalities and look at labor force changes in solely these rural areas. Counties and municipalities that were encompassed within a larger MSA were excluded from analysis, limiting the dataset to 34 rural municipalities in 20 rural counties. The same difference of means t-tests were used to assess labor force changes for the select indicators over time (Table 3).

Table 3: Difference of Means Test for Labor Force Indicators, Rural Areas Only

Indicator	Mean of counties	Mean of municipalities	County > municipalities p-value	Counties ≠ municipalities p-value	Municipalities > counties p-value
Change in Unemployment	.2854	-.0320	.9949	.0101***	.0051***
Change in home workers	-.1074	.6732	.0427**	.0854*	.9573
Change in business and professional services workers	-.0250	.0417	.2228	.4457	.7772
Change in Median Income	1.1411	1.4047	.5170	.9659	.4830

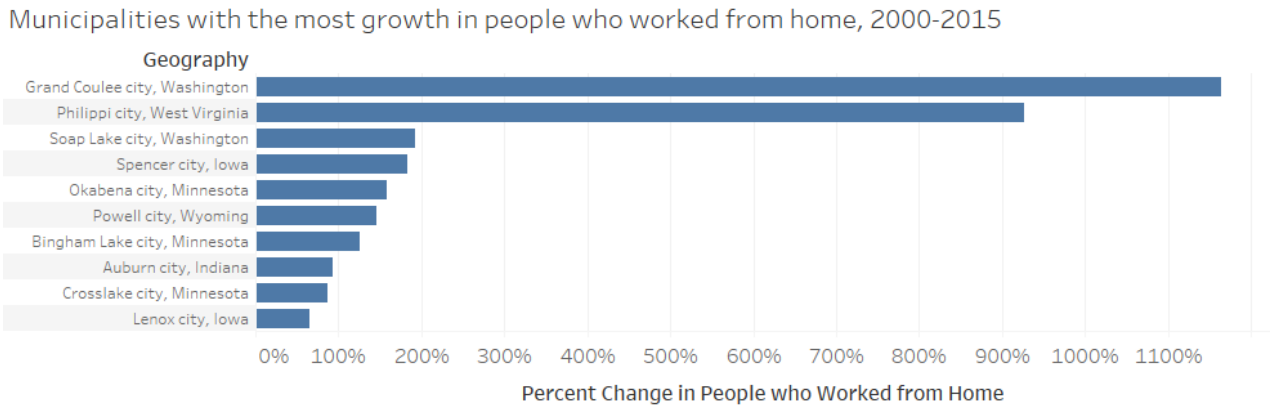
*Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

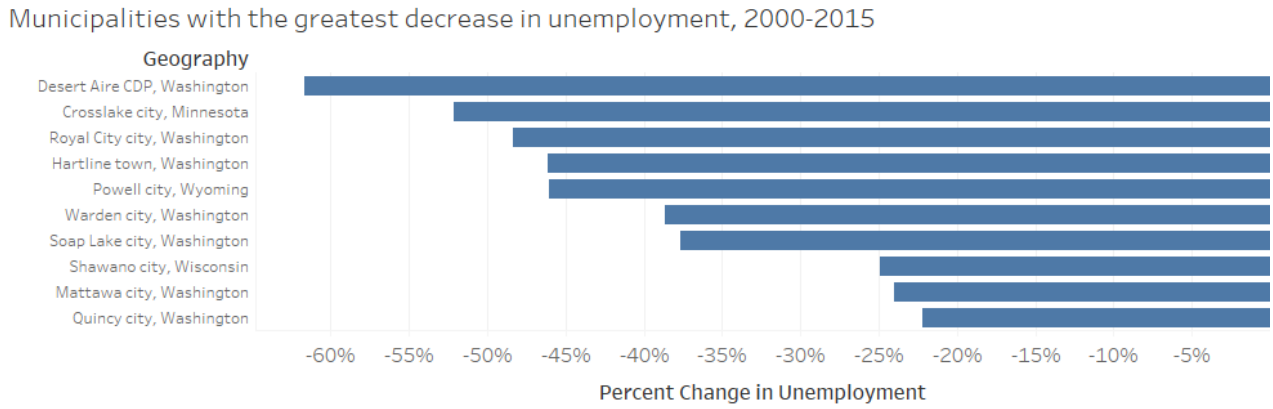
Once again, there was virtually no difference between rates of change for business and professional workers between the counties and municipalities, or for changes in median income from 2000-2015. However, the difference of means for rates of unemployment growth and change in the proportion of people who worked from home were more significant for this sample than for the analysis that also incorporated urban areas that are part of a larger MSA. Interestingly, on average, unemployment actually decreased in these rural municipalities from 2000-2015, at a rate of about 3.2%. This contrasts with the counties experiencing an average rate of 28% increases in employment in the same time period. These differences between groups are significant at the 99% confidence interval. In terms of the change in proportion of people who work from home, there was also a significant difference between the municipalities and counties; on average, the municipalities experienced a 67% increase in people who work from home, whereas in the counties, the proportion of home workers decreased by about 10% over the 15-year period. This difference, with the municipalities experiencing a higher rate of growth in people who work from home is significant at the 95% confidence interval. Again, although it is not possible to establish causation, the trends in unemployment rate and

proportion of people working from home are positive economic outcomes for these rural municipalities. There could well be other factors driving these changes; however, having a municipal fiber network seems like an asset for individuals in a rural municipality's labor force, especially for people who work from home and likely need robust internet access to work.

Based on the preliminary results of this statistical analysis, I wanted to hone in on a few select rural municipalities with fiber optic networks that could serve as exemplary case studies where unemployment has decreased and the proportion of people working from home has grown over the past 15 years, irrespective of overall county growth. To identify these municipalities, I visualized the best performing rural municipalities in terms the home workers and unemployment indicators, which showed significant differences from the county geographies (Figure 2). Although this data analysis is somewhat inconclusive, it serves as a way to identify promising case studies based on broad trends.

Figure 2: Top performing municipalities for significant labor force indicators



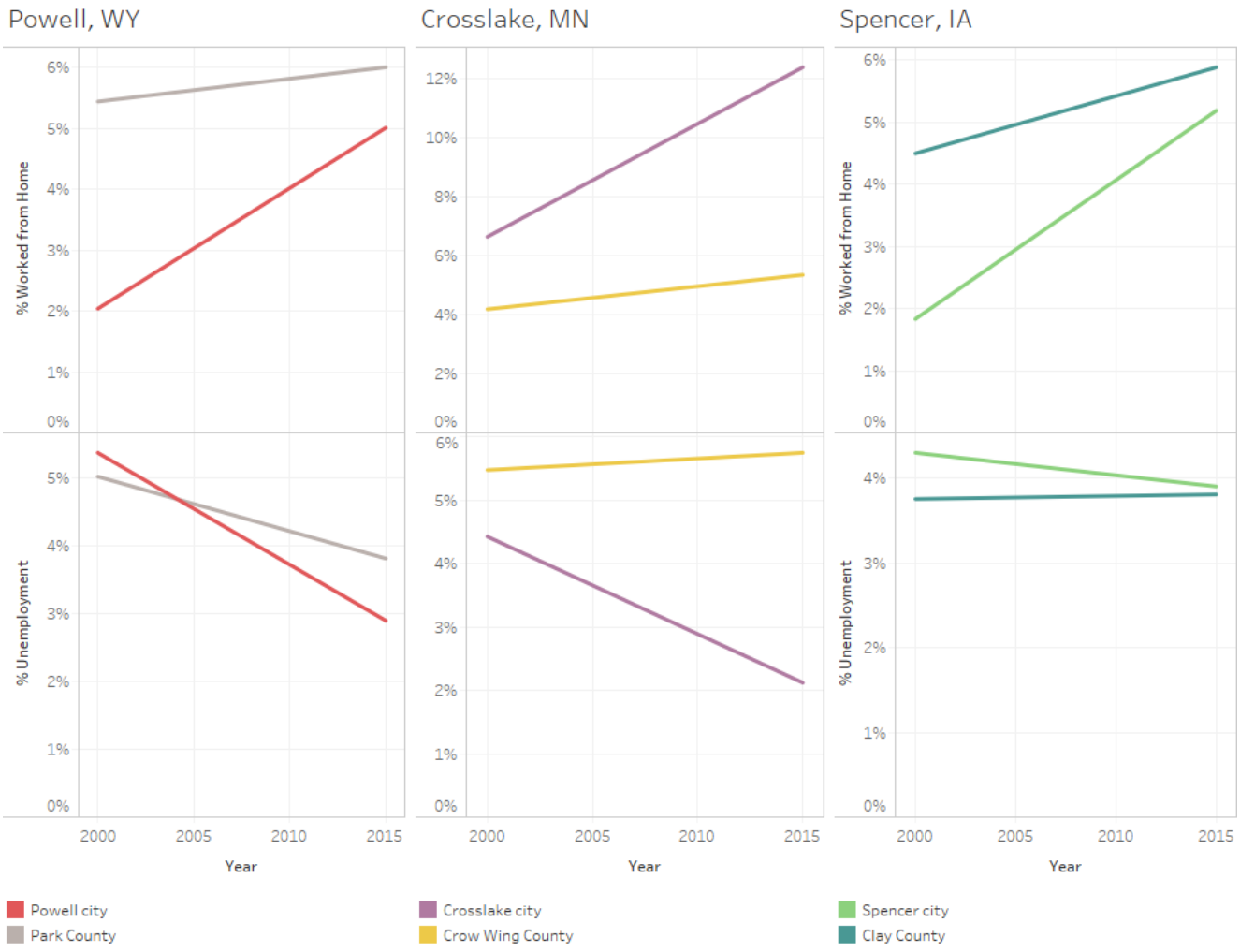


From this sorting process, there were several municipalities that had both substantial rates of increase in people working from home and decreases in unemployment. A few municipalities were in the top 10 performing municipalities for both indicators; these municipalities include Powell city, Wyoming, and Crosslake city, Minnesota. I also chose to focus on Spencer city, Iowa, which was also in the top 10 for growth of remote workers, and had a falling unemployment rate from 2000-2015. In order to better understand labor force trends in these municipalities and establish whether the presence of widespread municipal

fiber optic networks could have any relationship to these positive labor force and economic development outcomes, qualitative research methods are necessary.

In depth case study analyses were pertinent to help to unpack the labor force and economic development outcomes presented by this preliminary data, and better explain the growth in these indicators. However, before moving forward with qualitative case studies, it was important to isolate the three prospective case study municipalities and once again compare the select labor force indicators of home workers and unemployment to the overall county growth for each municipality. This analysis serves to establish precedent for further research; if the municipalities are experiencing much higher growth rates than their respective county geographies, this is an indication of some kind of competitive advantage that goes beyond overall regional growth. The significant indicators and for the three well-performing municipalities of Powell, Crosslake, and Spencer, and their respective counties are visualized to assess whether they may in fact have a competitive advantage that merits further research (Figure 3).

Figure 3: Potential Municipal Case Studies: Significant Indicators Performance Compared to Corresponding Counties



In all three of these municipalities, the rate of increase in the population of people working from home and the rate of decrease in unemployment are higher compared to the respective counties. All three municipalities saw an increase of at least 3% in the population of the labor force working from home, and decreases in unemployment over the same period. Although this could be explained by external factors, these labor force indicators could also

mean there is some kind of competitive advantage in these towns. Because all of these municipalities have invested in fiber optic networks, qualitative research can serve to tease out whether these fiber optic networks are positively impacting labor force outcomes, as the data may suggest, and whether other economic development initiatives or services also relate to these quantitative findings.

Case Study Research

Municipal Fiber Case Study: Powell, Wyoming

In the early 2000s, the town of Powell, Wyoming was far from being a town with a high-tech labor force. According Christine Bekes, the Executive Director of economic development in Powell, the town's economy has historically been tied to oil and gas industries, along with some agriculture and tourism. This is not unlike the rest of the state; in Wyoming, oil and gas are the dominant industries and employment trends are generally tied to the performance of these industries. However, in Powell, a town of about 6,500 residents in northwest Wyoming, labor force trends have begun to change in recent years. Despite the largest economic development challenge, which according to Bekes is low population density and therefore a shallow labor force pool, Powell has several interesting assets, including a municipal-wide fiber network, that are driving high-tech growth. According to Zane Logan, Powell's city administrator, recent economic growth in Powell is not unrelated to the implementation of their fiber optic network in 2008, which now is available to deliver gigabit broadband to 90% of all addresses within the municipal boundaries of Powell (Logan 2017).

This interesting initiative was largely led by Logan, who began thinking about Powell's broadband infrastructure needs back in 2006. Like some other municipalities in the US, Powell has been operating its own municipal electric utility for decades. Additionally, before 2008, the traditional cable provider in town, Spectrum, offered poor broadband at very high rates. Logan had the foresight to realize that because of the town's already existing electric infrastructure and lack of robust broadband by private providers, there was an opportunity to invest in fiber infrastructure for the town. More importantly, fiber infrastructure could be provided to the entire town, not just isolated areas such as a business or industrial park, so that all residents and businesses in Powell could reap the long-term benefits. Logan firmly believed that having robust citywide broadband infrastructure was critical to Powell's future economic growth. As he put it, it was "the same thing as paved streets; you just have to take the leap and build it." As a result of an innovative private-public partnership between the city of Powell, the network service provider TCT, and the network facilitator US MetroNets, the fiber optic network "Powellink" was built between 2006-2008 under Logan's oversight. The city only put up an initial $125,000 and the rest of the network was financed with $6.5 million in debt. Today, the city owns the physical infrastructure and it is operated by TCT. However, Logan stressed that it is an open network, so if other providers were interested in competing, they would be able to offer services via the city infrastructure as well (Logan 2017).

Getting the fiber optic network up and running was no simple process; in order to form the private-public partnership, the city of Powell faced several hurdles. In the initial stages of deploying the fiber, Logan offered for the incumbent cable provider to be the private partner.

Not only did they refuse, but the provider went to the state in hopes of enacting legislation to block municipal involvement in fiber deployment. Logan claims that when this failed, the provider attempted to offer new subscription deals to lock in customers that would potentially be lost to the network. Additionally, when the 2008 recession hit there were some financial issues with the low interest rates and the loan financing, but with the private partner of TCT the network was still able to get built. Today, over 40% of the town subscribes to fiber TCT services via Powellink; Logan says the network has been successful and is slowly building up customers and revenue over time. He emphasized the long-term nature of the investment.

Beyond these traditional monetary benefits to the town, Powell has seen interesting economic activity in recent years. In tandem with the fiber optic deployment, the Powell Economic Partnership (PEP) was formed as a "one stop shop for economic development in the area" (Logan 2017). Before PEP, there was no real economic development group outside of the traditional chamber of commerce. The core mission of the PEP, according to Bekes, is to build up existing businesses and focus less on recruiting new firms. Existing businesses includes the numerous remote workers in town, who Bekes claims have been steadily growing, although it is hard to quantify this population exactly. Most of these remote workers are consultants or people who are retired but still work part-time, and enjoy the quaint downtown and access to the outdoors that Powell has to offer.

In addition to catering to the existing labor force, the PEP does respond to leads from the state economic development office a few times per year. Logan emphasized that PEP has access to a "cheat sheet" he wrote, so PEP can provide pertinent information to businesses that

are considering Powell as a place to locate. He claims that one of the major items on this information sheet is the fiber optic capabilities, which allow businesses to tap into the municipality's gigabit speeds. Without this "check box item," many companies would not even look at Powell as a place of interest. For example, Logan is sure the fiber capabilities are attractive to a hotel developer that has entered a two-year deal to build a new hotel in Powell. The preliminary plan involves 84 rooms, each of which would need robust connectivity and Powellink will provide this at a low cost; the municipal fiber network is a huge asset for such a project.

According to Bekes, technology clusters typically form in areas where there are four-year universities and research institutes. Although Powell does have a small two-year college, there is no major university in the area. Despite this lack of a four-year institution, there are several ongoing high-tech developments happening in town. One element of this is a makerspace that utilizes the fiber network and allows small local businesses or college attendees to do manufacturing projects that include things such as robotics, 3-D printing, and lasers. Bekes emphasized that the capabilities of this space are very unusual for such a rural area and small town.

Even with the focus on existing businesses, the most exciting economic development in Powell is a recruitment project that is an ongoing effort between PEP and the city to attract a light manufacturing facility. This exciting opportunity involves a manufacturing company of unmanned aerial vehicles (UAVs), which are more commonly known as drones. The company plans to utilize the gigabit fiber network to do unmanned flight training at Powell's small

general aviation airport. According to Bekes, Powell's would be the first airport to have unmanned flight trainings in the country. More importantly, this opportunity is a way to diversify Powell's economy away from some of the more traditional industries in Wyoming and branch out to a new high-technology field. Bekes claims this new opportunity will help stabilize and grow employment in the region in the long run, especially because UAVs are supposed to have an $82 billion economic impact on the US economy by 2025 (Bekes 2017). Economic development officials in Powell see a venture into this new industry as something that was at least partially enabled by the robust fiber optic network that allows for high technology firms to locate within Powell's boundaries, in turn deepening the labor force talent pool in the area.

Municipal Fiber Case Study: Crosslake, Minnesota

Crosslake is a small, rural town of just over 2,000 people in northern Minnesota. As part of the Brainerd Lakes region, the economy has historically been tied to tourism, given that the lakes are a popular summer destination located about three hours outside of the Minneapolis-St. Paul MSA. However, according to the mayor of Crosslake Patty Norgaard, the Brainerd Lakes area is "definitely off the beaten path." There are no major freeways that run through the region, and so in terms of the economic development, Norgaard says Crosslake is aware that they would never be able to attract a large retail or manufacturing plant. Instead, the town's economic strategy revolves around building a competitive technology sector, with the regional organization Brainerd Lakes Area Economic Development Corporation (BLAEDC) spearheading this initiative.

The pinnacle of this effort is directly related to the deployment of municipal-wide fiber optic networks, which were installed for institutions in the Brainerd Lakes area in 2003, and then extended to all homes and businesses in Crosslake over the next few years. The fiber initiative was led by the local school district, which recognized there were potential gains to be made in education by increasing internet connectivity to all primary and secondary schools. This original institutional fiber network (I-NET) was eventually extended to homes and businesses via a public private partnership with CTC, which operates the network. In Crosslake, the city owns the physical infrastructure. According to Kevin Larson, the CEO of CTC, "the Brainerd Lakes Area's fiber optic initiative is now a model for how regional economies can grow businesses through high-tech investment and public-private partnerships" (BLAEDC 2016). Now, by the end of 2017, 100% of homes and businesses in Crosslake will have access to the fiber network.

However, similar to the case of Powell, Wyoming, incumbent private service providers have not been enthusiastic about these municipal-wide fiber efforts. CenturyLink/Charter, the active cable company in the Brainerd Lakes region, was part of an effort to enact restrictive legislation at the state-level. Now, wherever there is an incumbent provider offering any kind of broadband, public funds are not permitted to be spent on fiber optic infrastructure projects. However, Mike Bjerkness, the workforce director at BLAEDC, says that coverage was nonexistent in some areas of the Brainerd Lakes region, and some of those areas, like Crosslake, have capitalized on fiber investment. Additionally, in some cases, private firms such as CTC are building fiber infrastructure without public funds. One example of this is what Bjerkness calls

"shovel-ready" sites for businesses in areas surrounding Crosslake, which can be connected to fiber networks on demand.

With this widespread fiber access, the town of Crosslake and BLAEDC are actively recruiting both entrepreneurs and remote workers to the region. Similar to the case of Powell, the primary role of BLAEDC is to support existing local workers and businesses, and recruiting new firms takes a secondary role. According to Bjerkness, remote workers are a large economic driver that falls into both of these categories. With prevalent fiber infrastructure, tourists and second-home owners that used to come up for the weekend are now staying in Crosslake for weeks on end because of the robust internet capabilities in their cabins and homes. Bjerkness claims this has had a noticeable impact on the local economy; with these people staying for longer and longer, they are also spending more at local businesses.

Norgaard, the mayor of Crosslake, actually worked remotely for Wells Fargo for the first five years after she moved to Crosslake. She insists that there are many of these people that work from home in the community, as well as many "garage companies," or entrepreneurs that have started small firms in their homes and don't utilize formal office space. She points out that this entrepreneurial spirit is unusual, because like Powell, Crosslake does not have a four-year university. Nor do they have a startup incubator space, but Norgaard says this isn't something that seems necessary because there are so many garage companies. This is largely made possible by the fiber network, which had the most subscribers in 2016 since its inception in the mid-2000s. She insists that as a society we are "moving further and further into the world of technology. Technology is just as important to other industries now, like agriculture, as it is to

business" (Norgaard 2017). In fact, according to Bjerkness, over 75% of small businesses in all several different industries in Crosslake are connected to the fiber network.

To further bolster this emerging technology scene, BLAEDC is in the process of developing a "Tech Services Media Campaign," which is essentially a marketing report to spread knowledge about some of the success stories of the technology companies in Crosslake. The media report focuses on "showing how a community can benefit from public/private partnerships to bring fiber optic to an area" (BLAEDC 2016). This is important because statewide, only 16.5% of households in Minnesota have access to high-speed broadband internet. In contrast, there are now more than 20 high-tech companies in the Brainerd Lakes Area, because the fiber optic network allows them to move massive amounts of data very quickly, which is crucial to their business operations.

Several companies have indeed capitalized on the robust fiber network in Crosslake, as the media campaign espouses. Local entrepreneur Ben Gibbs founded his company Crosslake Sales, which specializes in online sales of bicycle parts, after moving to Crosslake in 2006. Back then, he said the cell phone coverage was very spotty, but they "had better internet service here than we did in the Twin Cities" (BLAEDC 2016). Today, he operates with a staff of 10 full-time employees. Another recent example is the company GovMint.com, which opened an office in Crosslake in 2009 and employs 25 people, which is a large contribution of talent in a small, rural economy. Jim Martin, the director of sales, claims that the two primary reasons they chose to add an office in Crosslake were (1) the workforce and (2) the broadband service (BLAEDC 2016). Most recently, entrepreneur and MIT graduate Brent Backhaus moved his new

company Living Window to Crosslake. After spending years in the telemedicine industry, this new endeavor is a software program designed for Alzheimer's patients. He claims that the fiber optic infrastructure in Crosslake has been critical to his company's success and that "that part of the technology is better than anywhere else I've worked" (BLAEDC 2016). There is no doubt that reliable high-speed internet provided by the fiber network plays a critical role in the location decision-making process for many high technology entrepreneurs. The fact that Crosslake can offer this is helping to develop and grow the workforce.

Municipal Fiber Case Study: Spencer, Iowa

Spencer, Iowa is located in Clay County and has a population of roughly 11,200. An early investor in municipal telecommunications, Spencer is a rural town that began offering municipal broadband services in 2000 via Spencer Municipal Utilities (SMU). Although these were initially cable services, Spencer spent the first decade of the 21st century slowly upgrading to a fiber optic network as the demand for bandwidth from residents continued to rise. According to Curtis Dean, the telecommunications coordinator for the Iowa Association of Municipal Utilities, these early investments were made in several towns across Iowa. In fact, 28 municipalities in Iowa now offer some kind of municipal broadband services. This is partially due to the fact that Iowa is a home rule state, which gives communities more power to make decisions without regard to the state legislature (Dean 2012). Additionally, Iowa has a long history of self-reliance that began with its numerous farmer co-ops, and was later followed by telephone co-ops, and municipal electric utilities to extend services where private providers would not. As Dean sees it, the jump to municipal-wide broadband was no different; if a new

innovation comes along and private providers are not doing enough, it is up to the public to act. According to Kiley Miller, the president of the Iowa Lakes Corridor Development Corporation, the jump to municipal-wide broadband has resulted in "bulletproof telecommunications" in Spencer, with an estimate of over 90% of local businesses subscribing to the SMU network, including all of the manufacturing businesses in town (Miller 2017).

However, the implementation of the municipal-wide fiber optic network was not an entirely smooth transition in Spencer. Similar to other communities in other states, Spencer saw pushback from the private sector and the state legislature in the mid-2000s, when they attempted to reverse the home rule provision and block municipalities building out their own networks. Luckily, these attempts were unsuccessful and Spencer reaps economic development benefits from its own, robust network. Dean claims that the biggest economic development impact has been for existing small businesses (5-50 employees) that have been able to utilize the fiber network to expand operations, keeping locals employed in town and avoiding relocation. He cites the example of Hansen's Clothing, a family owned business that has been selling upscale men's clothing in Spencer for decades. However, in the early 2000s, the store was losing business due to new competition from online retailers. Instead of closing down, Hansen's was able to connect to the fiber network, set up a web server and begin selling clothes online to stay competitive. Access to new, online markets has resulted in people all over country buying their clothing, and revenues are through the roof (Dean 2012).

It is not only local businesses that have benefited from the municipal fiber network, but also individuals. Miller claims that the robust internet capacity has opened up employment

opportunities for self-employed and remote workers, which he has begun to gather data on for the Iowa Lakes Community Development Corporation. For example, local entrepreneur Tim Frank has built an entire career around providing online marketing services for retailers, utilizing the SMU gigabit fiber internet he gets delivered to his home in Spencer. Another local entrepreneur utilizes the fiber network to sell custom t-shirts with high-definition images via online markets. Although the t-shirts are actually manufactured in Australia, the entrepreneur is able to operate the business out of his home in Spencer, again due to the robust SMU internet services.

Additionally, Miller claims that the robust fiber network has helped the town address the "trailing spouse challenge," which is especially prevalent in rural America. In recent years, Miller believes that the number of people who have relocated to Spencer and kept their job in a previous location by telecommuting—or working remotely—is on the rise. The gigabit fiber network can serve as a resource, especially for those who are brought to Spencer by a partner's job, by enabling them to work remotely from home (Miller 2017). This is true not only for "lagging spouses" but also for a small population of early retirees that have been drawn to the Spencer region by outdoor recreation, specifically a large lake just north of Spencer. Miller said that many of these retirees continue to work part-time for their previous jobs to sustain income, or work as freelance consultants using the SMU network (Miller 2017). Although the Iowa Lakes Community Development Corporation is still in early stages of collecting remote worker data, this is an initiative they are currently targeting to part of their workforce

development strategy. By making sure individuals relocating to Spencer are aware of the bulletproof telecommunications services, they can continue to grow a robust local labor force.

Along with supporting local businesses and individuals in town, Dean estimated that last year, there were over $1.7 million in consumer savings from increased competition and lower rates resulting from the presence of the SMU network. These annual cost-savings to consumers mean more potential investment in the local community. Unlike some rural areas that are in decline, Spencer has experienced modest gains in population over the past decade, and has a stabilized, diversified labor force. More than anything, both Dean and Miller view Spencer's municipal telecommunications investment as a way to tackle inequality in the community and the larger looming issue of the urban and rural divide in America.

Lessons & Implications

From the broad data analysis and case study analysis, it is clear that in many instances, there are long-term economic development and labor force benefits that accrue to municipalities that invest in fiber optic networks, especially in rural communities where broadband access is limited due to a lack of private service providers. This research provides evidence that on average, communities that have made these investments have seen gains in changes in unemployment and remote workers since 2000. Additionally, the anecdotal cases of Powell, Crosslake, and Spencer provide further evidence of the unquantifiable benefits of municipal-wide fiber access to economic development in their towns. Therefore, the question remains why more municipalities are not making these investments. In reality, a municipality's

decision to invest in fiber is complicated; there are many variables that can make or break this type of project and there is no one-size-fits-all-approach.

Some of the pertinent issues a municipality has to grapple with when considering this decision are available sources of financing, external support systems, and the legal environment. For example, one lesson is that many towns in this analysis were able to issue municipal bonds to finance fiber without utilizing taxpayer dollars. In other cases, municipalities contributed a lump sum at the start of the project, matched funding with federal grants, or leveraged private partners to obtain commercial bank loans. Depending on the municipality, some of these financing options are more desirable than others. Regardless, last-mile, fiber-to-the-home (FTTH) infrastructure projects are expensive and take several years to complete. Although the 73 municipalities presented in this research have networks that are up and running, they may not be feasible investments for many rural towns in the US, especially without larger federal grants or subsidies.

Additionally, an important lesson that has emerged from this research is that external support systems can make or break a project. In many successful cases, such as Powell and Spencer, the presence of an existing municipally-operated electric utility can drive municipal fiber investment. Pre-existing municipal utilities make it much easier for a town to implement and take ownership of the physical fiber infrastructure, because some of the infrastructure is already there. External support systems also come in the form of available private partners. In the cases of Powell and Crosslake, having a strong private partner willing to operate the network enables the projects to go through. Although there are some cases, such as

Chattanooga and Spencer, of municipalities operating fiber networks on their own, it seems more common for a specialized private operator to deal with service offerings and operations. Likely, many small municipalities do not have the internal resources or expertise to fulfill the operations role. In order to make these investments worthwhile, it is also important for municipalities to acknowledge the state of their current economy and labor force. For example, municipalities such as Crosslake have seasonal populations to draw from; with the implementation of FTTH networks, they were able to capitalize on tourists and second home-owners as customers who already had an active interest in the municipality. With fiber optic networks, these populations were incentivized to spend more time in the area because robust connectivity made working in the area feasible. In municipalities lacking a population that would stand to benefit from subscribing to fiber services, it is possible that municipal fiber would not be a worthwhile endeavor.

Perhaps the largest lesson that can be drawn from this research has to do with the legal issues surrounding municipal fiber networks. In the cases of Powell, Crosslake, Spencer, and many other municipalities, there has been strong pushback from private telecommunications companies regarding municipal-led fiber deployment. This can be explained by the nature of the broadband services industry. Similar to roads and electricity, broadband has very high fixed implementation costs, in the form of large upfront infrastructure investments to ensure supply. Due to these high fixed costs, in many geographies, especially rural areas with low population densities, firms are unwilling to offer any services because the number of subscribers in the market will not offset the fixed costs of implementation. Alternatively, in many rural

communities there is only one service provider; firms are able offset their fixed costs by offering very high subscription rates to homes and businesses, made possible due to the lack of industry competition. This makes the private broadband provider industry a natural monopoly, where a few telecommunications firms, such as AT&T, Time Warner and Comcast, dominate the market.

As evident by the literature and case study research, these firms resent municipal-led fiber optic networks that increase competition in the industry by offering better services, often at lower rates. In several states, large telecommunications firms like AT&T and Time Warner have had an influence on passing state policies that restrict municipal involvement in fiber networks, in order to protect their monopolistic interests. This is done in the form of threatening lawsuits, as was the case in Powell, and also aggressive lobbying and campaign donations (Holmes 2014).[7] Two landmark cases that have to do with municipal fiber in Chattanooga, TN and Wilson, NC have garnered national attention and represent this clash between state and federal policies. In the 2000s, these municipalities took on debt to build citywide high-speed fiber networks that are operated by the municipalities' existing electric utilities and delivered to all homes, schools and businesses. The networks began operating before restrictive state policies were enacted, and were therefore grandfathered in to their respective state laws. However, when Chattanooga and Wilson tried to expand broadband service to areas outside the municipal borders into other towns and extra jurisdictional

[7] In North Carolina the Bill H129 was pushed by Time Warner as a "An Act to Protect Jobs and Investment by Regulating Local Government Competition with Private Business" (Mitchell 2011). The Act prevents municipalities from operating networks outside their borders and would require municipalities to impute private provider prices.

territories (ETJs) the states objected. Ultimately, an appeals court upheld the state laws on the grounds that the Telecommunications Act lacks clear language to say the FCC can interfere with state-subdivision relationships (Roberts 2016). Today, there are 19 states with restrictive municipal broadband policies that any municipality considering fiber investment should be aware of (Appendix V). The defeat of Wilson and Chattanooga, as well as similar cases, makes it financially and legally difficult for municipalities to expand networks and offer services going forward in states with these restrictive policies. However, utilizing private partners and forming non-profit public-private partnerships can be one way to navigate around some of this legislation, with the goal of expanding broadband access.

Overall, there are many variables that a municipality has to weigh when considering fiber optic investments. Ideally, this research and additional research on economic outcomes related to public broadband initiatives will lead to a better understanding of the long-term external benefits of these investments. With better access to financing, external support systems, and less regulatory barriers, municipalities and other agencies can address this aspect of the problem of the digital divide in a timely manner.

Conclusion

This vital research pertaining to municipal fiber optic networks fits within the broader scope of increasing broadband to communities in the US for long-term, equitable economic progress. As of 2016, 10% of all Americans lack access to broadband, and 39% of rural

Americans lack access to broadband (FCC 2016).[8] Additionally, only 29% of Americans have the option to choose from more than one broadband service provider (Poole 2015). Clearly, without initiatives such as municipal involvement in broadband deployment, many Americans continue to be isolated from technological and economic progress experienced by the rest of the nation. However, the fact remains that municipal fiber networks are only one approach to addressing this problem; in other instances, broadband issues can be addressed at the county-level, or via public investments in cable or wireless networks. Looking at municipal fiber networks is just one way to pinpoint the impacts of widespread access to fast, reliable broadband in relation to economic development and labor force outcomes in small rural areas across the US. Ultimately, the hope is that public involvement can help to remedy the ever sharper economic and social inequity between those that have access to the wealth of information empowered by robust information and communications technologies and those that have no access and are getting left behind in an obsolete realm.

[8] The FCC defines broadband as a minimum of download speed of 25 megabits per second and a minimum upload speed of 3 megabits per second (FCC 2016).

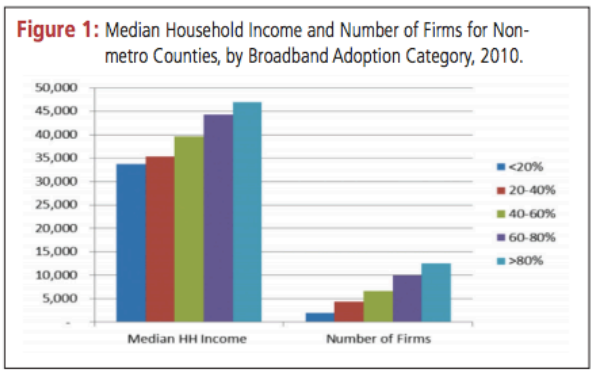
Appendix

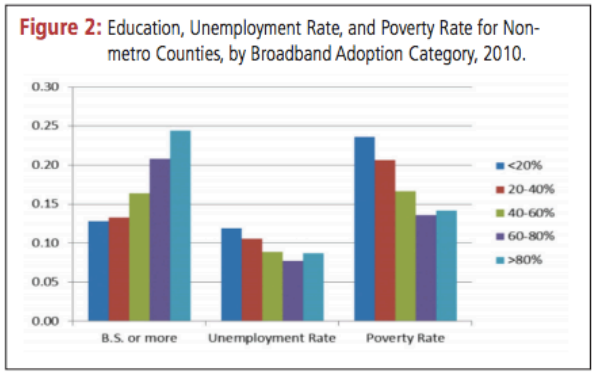
I. Internet Connection Types

Type of Internet Connection	Description
Digital Subscriber Line (DSL)	Uses the phone line (copper electric cable) to connect to the internet; generally stable speeds, but quite slow by today's standards, capped at around 5 mbps.
Cable	Uses the television cable (copper electric cable) to connect to the internet; broadband speed varies depends on number of users in an area at one time, with connection speeds declining with increased users.
Wireless	Broadcasts an internet connection over radio waves. The speeds generally fast, but are subject to weather, and decline with distance from the broadcasting source.
Fiber	Transmits information by sending light pulses through an optical cable, made of glass or plastic, which make them unsusceptible to electromagnetic interference. Broadband speeds can be up to 1000 mbps.

Source: Lieber 2015.

II. Broadband's Contribution to Economic Health in Rural Areas





Source: Whitacre 2015.

III. Full List of Municipalities with Fiber Optic Networks and Dates of Implementation

Municipality	Year Implemented
Abingdon town, Virginia	2001
Auburn city, Indiana	2007
Bagley city, Minnesota	2011
Bellevue city, Iowa	2009
Bingham Lake city, Minnesota	2011
Brewster city, Minnesota	2011
Brigham City, Utah	2003
Bristol city, Tennessee	2005
Bristol city, Virginia	2001
Cashmere city, Washington	2002
Cedar Falls city, Iowa	2011
Centerville city, Utah	2003
Chattanooga city, Tennessee	2009
Chelan city, Washington	2002
Clarksville city, Tennessee	2009
Crosslake city, Minnesota	2003
Dalton city, Georgia	2003
Desert Aire CDP, Washington	2001
East Ridge city, Tennessee	2009
Grand Coulee city, Washington	2001
Hartline town, Washington	2001
Heron Lake city, Minnesota	2011
Highland city, Illinois	2010
Holland city, Michigan	2003
Independence city, Oregon	2006
Jackson city, Minnesota	2011
Jackson city, Tennessee	2004
Kennewick city, Washington	2002
Kutztown borough, Pennsylvania	2007
Lafayette city, Louisiana	2009
Leavenworth city, Washington	2002
Lenox city, Iowa	2010
Loma Linda city, California	2005

Longmont city, Colorado	2014
Lookout Mountain town, Tennessee	2009
Marshall city, Missouri	2002
Mattawa city, Washington	2001
Monmouth city, Oregon	2006
Monticello city, Minnesota	2010
Morristown city, Tennessee	2006
North Kansas City city, Missouri	2006
Okabena city, Minnesota	2011
Opelika city, Alabama	2010
Pasco city, Washington	2001
Philippi city, West Virginia	2005
Powell city, Wyoming	2008
Prosser city, Washington	2002
Pulaski city, Tennessee	2009
Quincy city, Florida	2004
Quincy city, Washington	2001
Red Bank city, Tennessee	2009
Reedsburg city, Wisconsin	2002
Ridgeside city, Tennessee	2009
Rossville city, Georgia	2009
Round Lake city, Minnesota	2011
Royal City, Washington	2001
Russellville city, Kentucky	2010
Salisbury city, North Carolina	2010
Sallisaw city, Oklahoma	2005
Sebewaing village, Michigan	2014
Shawano city, Wisconsin	2008
Signal Mountain town, Tennessee	2009
Soap Lake city, Washington	2001
Spencer city, Iowa	2000
Tremonton city, Utah	2003
Tullahoma city, Tennessee	2009
Vernon city, California	2013
Warden city, Washington	2001
Wenatchee city, Washington	2002

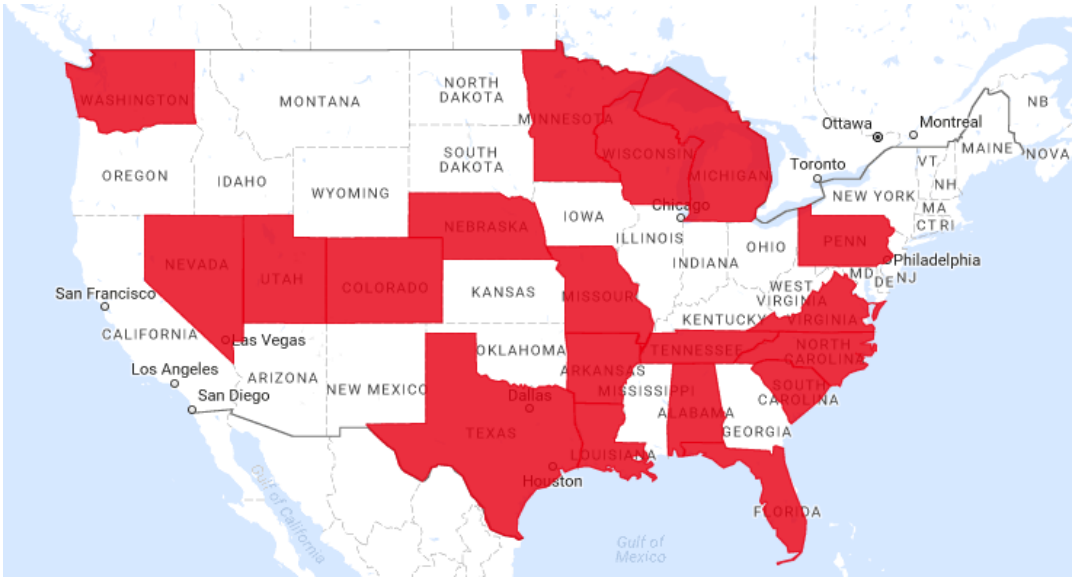
Wilder city, Minnesota	2011
Wilson city, North Carolina	2008
Wilson Creek town, Washington	2001
Windom city, Minnesota	2005

Sources: Gonzalez 2017. Institute for Local Self-Reliance 2015. Obama White House Archives 2015.

IV. Unemployment in 2000

	Municipalities	**Counties**
Mean Unemployment (2000)	6.8%	4.4%
Standard Deviation	5.7%	2.1%

V. States with Restrictive Municipal Broadband Policies



Source: Institute for Local Self-Reliance 2015.

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